

REMARKS

This communication is responsive to the Office Action dated February 27, 2002 (The Office Action). Claims 1-22 are pending in this response. Clear differences between the claims as originally submitted and the prior art of record make amending the claims unnecessary. Reconsideration of the pending claims is requested in view of the following remarks.

Claim Rejections - 35 U.S.C. § 103

All pending claims 1-22 were rejected under 35 U.S.C. § 103(a) as unpatentable over combined references. Each combination of references includes U.S. Pat. No. 4,156,144 issued to Pike et al. (hereinafter "Pike"), and U.S. Pat. No. 4,951,294 issued to Basu et al. (hereinafter "Basu").

Independent claims 1, 15, 19, and 22 were rejected over Pike in view of Basu. The dependent claims 2-14, 16-18, and 20-21 were rejected over either solely the combination of Pike and Basu, or the combination of Pike and Basu in light of other references. Because the combination of Pike and Basu fails to teach or fairly suggest the claimed invention as recited in the pending independent claims 1, 15, 19, and 22, the applicants respectfully disagree with the rejections.

The applicants respectfully traverse each of the foregoing rejections, and assert that the proposed combinations of references fail to present a *prima facie* case of obviousness for any pending claim.

The Pike and Basu Combination

With reference to Fig. 5 of Pike, The Examiner stated in the Office Action that:

Pike teaches a laser cavity, defined by mirrors 124 and 126, gain medium 120 which lies therein, and that is optically pumped by source 122. In addition, present in the laser cavity is the crystal 130 connected to the power amplifier and the sine wave generator, which will produce the wavelength sweeping. What Pike fails to teach is a modelocking element in the cavity for pulsed output formation.

The Examiner then stated that the mode-locking element in the cavity for pulsed output formation, which Pike fails to teach, is instead taught by Fig. 1 of Basu. The applicants do not dispute the accuracy of these statements because it is unnecessary to do so. Even if the references were combinable, elements of the claimed invention would still be lacking.

Independent claims 1, 15, 19, and 22 do not claim a separate mode-locking element or a method of mode-locking as required by Basu. For example, although claim 1 recites, in part, a laser "wherein the laser output is short mode-locked pulse type," that is where the similarity ends. Claim 1 does not recite a mode-locking element or "mode locker" as taught by Basu. Basu explains that his "mode locker" is typically an acousto-optic modulator modulated at the mode-locking frequency (column 3, line 21; abstract, line 10). However, this is precisely the type of conventional mode-locking element that the applicants' invention seeks to avoid (Application, page 2, lines 14-25).

A distinguishing feature of the applicants' invention as compared to the Basu reference is the novel way in which mode locking is achieved. Indeed, "the wavelength-swept pulse laser of the present invention is based on a new finding that [a] sufficient amount of non-linear phase generated by the non-linear medium disposed in the resonator can induce spontaneous mode-locking." (Application, page 5, lines 20-22).

Rather than using a "mode locker" in the form of a single element acousto-optic modulator as taught by Basu, the combination of the claimed wavelength tunable filter and the claimed non-linear medium with light intensity dependent refractive index recited in independent claims 1 and 15 provide spontaneous mode locking through inducement of a self-phase modulation effect. (Application, page 3, lines 25-28; page 4, lines 4-12; page 5, lines 23-26; page 7, lines 12-16; page 10, lines 9-12).

The self-phase modulation effect tends to widely broaden the spectrum of the pulses generated, and this spectral broadening is an essential feature of the claimed mode-locking technique. (Application, page 7, lines 12-16). However, Basu teaches away from the use of this effect since one advantage of his invention is the fact that dispersive pulse broadening is minimized (column 4, lines 24-25).

As yet another indication that the combined references teach away from the claimed subject matter, Basu states that the placement of the mode-locker within the resonator substantially affects the efficiency of mode-locking, and therefore the mode locker is preferably located close to the output mirror or output coupler. (column 3, lines 17-23). Conversely, applicants' invention is not so limited. The placement of the claimed non-linear medium and the claimed wavelength tunable filter do not effect the operation of the resonator (page 7, line 25-27).

Similarly, and for the same reasons discussed above, the combination of Pike and Basu fails to teach the novel method of mode-locked laser pulse generation recited in independent claim 15 including, in part, “preparing a wavelength tunable filter and a non-linear medium with light intensity dependent refractive index.”

The Pike and Basu combination also fails to teach the laser recited in independent claim 19 and the method of laser light generation recited in independent claim 22 that both include, in part, “a wavelength tunable filter with minimum loss center frequency range.”

Claims 1, 5, and 15-22

Based on the argument above, even if there was a motivation for one of ordinary skill in the art to combine the teachings of Pike and Basu, the resulting combination would not result in the wavelength-swept pulse laser described in independent claim 1, the method of mode-locked laser pulse generation recited in independent claim 15, the laser recited in independent claim 19, or the method of laser light generation described in independent claim 22. As a necessary result, neither would the Pike and Basu combination result in a device covering dependent claims 5, 16-18, and 20-21. Applicant respectfully requests that these rejections be withdrawn.

Claims 2-4, 6-14

These dependent claims were all rejected based on a combination of Pike and Basu as applied to claims 1, 5, and 15-22, and another reference. Claims 2-4 and 6-14 each depend from independent claim 1. Because the application of the Pike and Basu reference to claim 1 is fatally flawed as described above and fails to teach the subject matter of claim 1, claims 2-4 and 6-14 are also allowable despite the additional third reference. Applicant respectfully requests that these rejections be withdrawn.

CONCLUSION

For the foregoing reasons, reconsideration and allowance of claims 1-22 of the application is respectfully requested. The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.



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PATENT TRADEMARK OFFICE

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

No changes were made to the claims.